

Claims

1. A method of forming a radially expandable externally grooved tubular fastener from metal, comprising the steps of:-

5 providing a suitable tubular blank having a tubular wall;

and squeezing the tubular wall between an internal member with a surface which engages the internal tubular wall face of the blank and a plurality of
10 external members provided with suitably shaped surfaces engaging the external tubular wall face of the blank;

thereby to form grooves on the external tubular wall face of the blank.

15 2. A method as claimed in claim 1, in which the squeezing is achieved by the effective decrease in diameter of the engagement of the suitably shaped surfaces of the external members with the external tubular wall face of the blank.

20 3. A method as claimed in claim 1, in which the squeezing is achieved by the effective increase in diameter of the internal member with the internal tubular wall face of the blank.

4. A method as claimed in claim 1, in which the squeezing is achieved by both
25 the effective increase in diameter of the engagement of the internal tubular member with the internal tubular wall face of the blank and the effective decrease in the diameter of engagement of the suitably shaped surfaces of the external members with the external tubular wall face of the blank.

5. A method as claimed in claim 1 or claim 2, in which the internal member engages the internal tubular wall of the blank as aforesaid at an unchanging diameter, and the external members are progressively closed on to the external wall face of the tubular blank to form grooves thereon as aforesaid and are then withdrawn from engagement with the external tubular wall face
30 of the blank thereby to release the grooved blank.
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6. A method as claimed in claim 5, in which the external members when closed on to the external tubular wall face of the blank form grooves thereon as aforesaid and also form a plurality of radially extending lugs or other protrusions thereon.
- 5 7. A method as claimed in claim 6, in which the external members are closed on to the external tubular wall face of the blank so as to leave a space between each member and the next, thereby to accommodate the protrusions from the grooves.
- 10 8. A method as claimed in claim 7, in which the opposed walls of adjacent external members which define the spaces between them also assist in forming the protrusions.
- 15 9. A method as claimed in claim 1 or claim 3, in which the external members are initially closed together in a predetermined spatial relationship to each other, and the internal member engages the internal tubular wall face of the blank with an increasing diameter, thereby to radially expand the tubular wall into the shaped surfaces of the external members which engage it, and the
20 external members are then withdrawn from engagement with the external tubular wall face of the blank so as to release it.
- 25 10. A method as claimed in claim 9 in which the external members remain in the same aforesaid spatial relationship with each other until they are withdrawn as aforesaid to release the blank.
- 30 11. A method as claimed in claim 4 or claim 9, in which the external members are first progressively closed on to the external tubular wall face of the blank to as to engage it as aforesaid and at least partially form grooves in it, and the internal member engages the internal tubular wall face of the blank with an increasing diameter, thereby to assist in the formation of the grooves.
- 35 12. A method as claimed in claim 3 or claim 9, in which the internal member has an external diameter which varies along its length, and is moved axially with respect to the tubular blank thereby to increase the diameter which engages the internal tubular wall face of the blank as aforesaid.

13. A method as claimed in any of claims 1 to 12, in which the grooves on the external tubular wall face of the blank are in the form of circumferential grooves.
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14. A method as claimed in any of claims 1 to 12, in which the grooves on the external tubular wall face of the blank are in the form of a screw thread.
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15. A method as claimed in any of claims 1 to 12, in which the grooves on the external tubular wall of the blank are in the form of longitudinal grooves.
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16. A method of forming a radially expandable tubular fastener substantially as hereinbefore described with reference to Figures 1A to 1N, or Figures 2A to 2K, or Figures 3A to 3M, of the accompanying drawings.
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17. A fastener formed by a method as claimed in any of the preceding claims.
18. A fastener, substantially as hereinbefore described with reference to, and illustrated in, Figures 1J and 1K, or Figures 2J and 2K, or Figures 3J and 3K, or Figures 4A and 4B, or Figures 5A and 5B of the accompanying drawings.
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2/13

Fig.1E

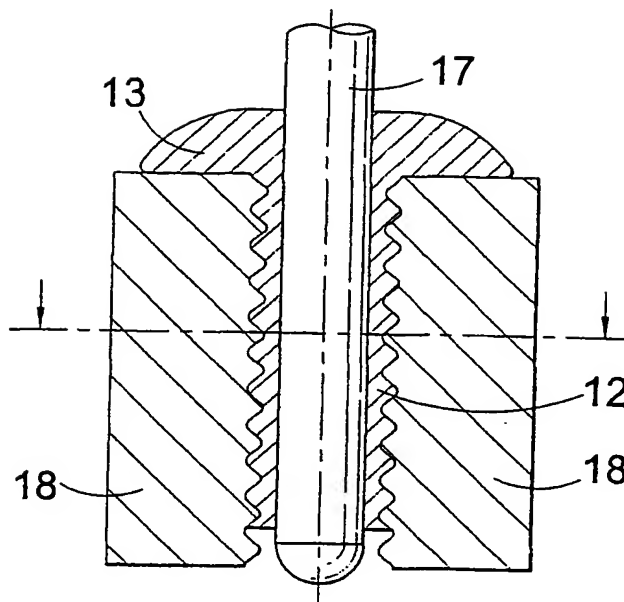


Fig.1F

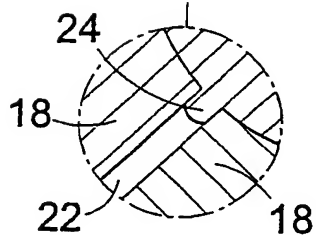
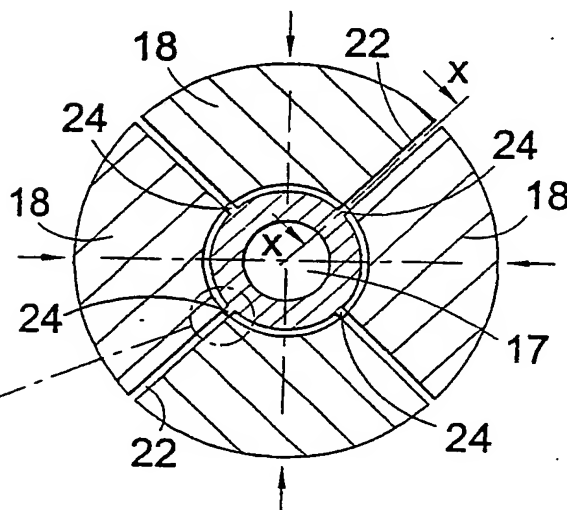


Fig.1M

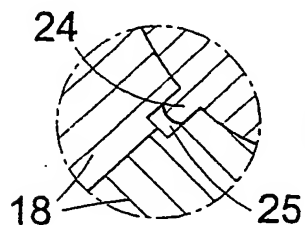


Fig.1N

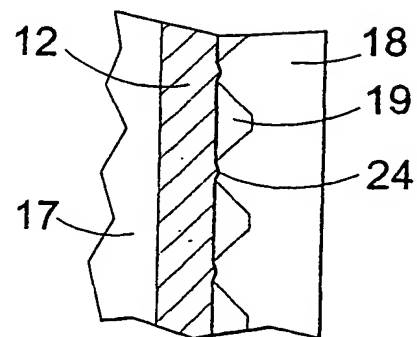


Fig.1L

3/13

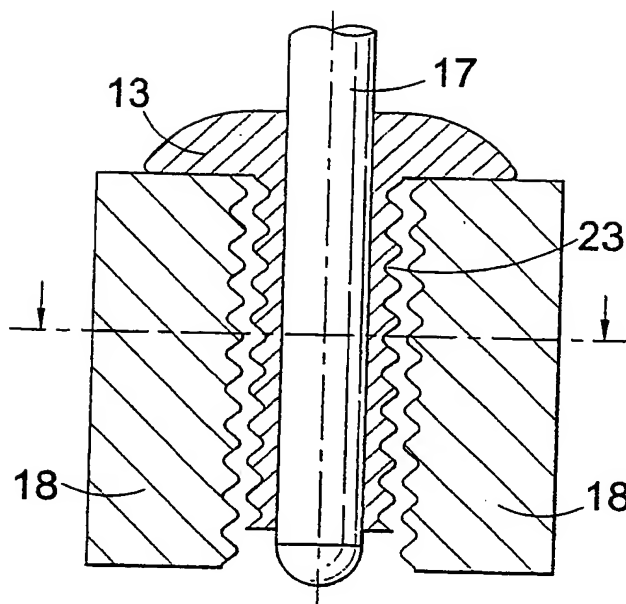


Fig.1G

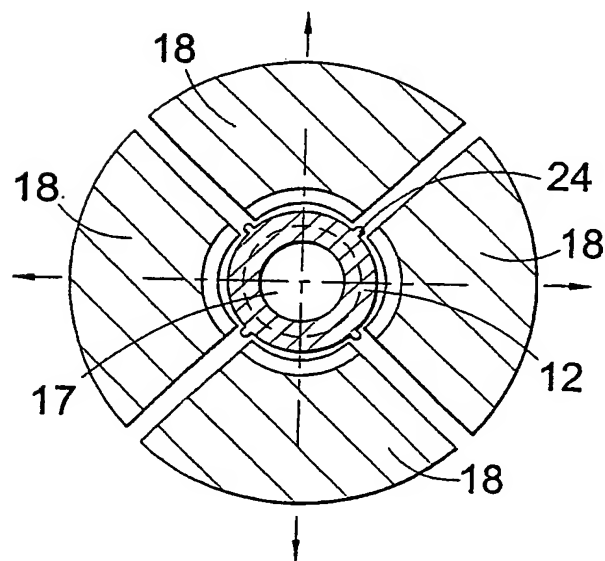


Fig.1H